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INDIVIDUAL PLANNING AND IN VIVO DOSIMETRY OF RADIATION THERAPY FOR CANCER OF THE CERVIX AND BODY OF UTERUS

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Modern methods of combined radiation therapy of patients with cervical and uterine body cancer are considered. The results of *in vivo* dosimetry carried out in Vitebsk regional clinical oncological dispensary to check the correctness of the dose in brachytherapy of oncogynecological patients are analyzed.

Keywords: cervix uteri and corpus uteri, beam therapy, intracavitary radiotherapy, 2D-planning, 3D-planning, in vivo dosimetri.

Radiation therapy as an independent method or as a component of combined treatment is used in more than 90% of cases of cervical and uterine body cancer [1]. Planning of oncogynecological patients consists in selection of optimal standard techniques for each specific clinical situation.

High quality of pre-radiation preparation and radiation treatment of oncogynecological patients with the use of conformal irradiation is possible in the presence of modern radiotherapy complex. In the Vitebsk regional clinical oncology center (Vitebsk, Belarus) is used for this radiotherapeutic complex manufactured by VARIAN MEDICAL SYSTEMS, which includes linear accelerators, Clinac iX and Theeven with multileaf collimator and Brachytherapies apparatus 200e VariSource and GammaMed.

Radiation therapy of patients with cervical and uterine body cancer includes remote and intracavitary radiation. Control of the correctness of remote radiation treatment and patient styling is carried out using the OBI system or Portal Vision, by comparing the images with the planned. This creates favorable conditions for subsequent intracavitary gamma therapy. The advantage of contact radiation therapy is to obtain high doses of radiation, locally in the target volume, with a rapid dose decline in the surrounding healthy tissues. 2 orthogonal x-rays are used in 2D brachytherapy planning. The difference between the dose received by the patient and the planned dose is assessed by *in vivo* dosimetry [2].

In Vitsebsk regional clinical oncology center with the help of in vivo dosimetry, the correctness of the dose in brachytherapy was checked for 14 patients (Table 1). For this purpose, we used a KIT for *in vivo* dosimetry firm PTW, which includes an applicator with five consecutive detectors for the rectum and a detector for the urethra. In the process of radiotherapy sessions was filmed doses of data from these detectors and compared with the data in the same points calculated on the planning system.

Table 1

№	Absorbed dose of ionizing radiation												Error, %					
	The value of the sensors from the plan, Gr.						The measured value, Gr.											
	R1	R2	R3	R4	R5	Bladder	R1	R2	R3	R4	R5	Bladder	R1	R2	R3	R4	R5	Bladder
1	1,496	2,329	2,888	3,735	4,320	2,089	2,210	2,567	2,644	2,328	1,902	2,302	32,3	9,3	-9,2	60,4	127,1	9,3
2	5,450	8,708	12,608	13,354	10,071	6,620	5,735	7,155	8,118	7,858	6,916	7,203	5,0	21,7	55,3	69,9	45,6	8,1
3	3,044	5,136	7,484	7,198	4,259	12,830	5,170	6,606	-	6,128	4,928	8,104	41,1	22,3	-	17,5	13,6	58,3
4	1,371	2,017	2,958	3,346	2,237	2,194	1,681	2,216	2,310	2,088	1,591	1,979	18,4	9,0	28,1	60,2	40,6	10,9
5	3,200	4,401	6,096	6,369	4,156	12,403	3,766	4,796	5,534	4,989	3,476	7,785	15,0	8,2	10,2	27,7	19,6	59,3
6	3,049	4,120	5,003	4,131	2,492	6,736	3,858	4,574	4,381	3,335	2,097	5,818	21,0	9,9	14,2	23,9	18,8	15,8
7	2,544	3,982	5,803	4,894	2,911	6,552	4,153	5,781	5,509	4,810	3,079	4,951	38,7	31,1	5,3	1,7	5,5	32,3

8	1,448	2,045	2,768	3,352	2,603	2,491	1,619	2,101	2,547	2,392	2,178	2,467	10,6	2,7	8,7	40,1	19,5	1,0
9	4,441	6,162	7,485	7,825	6,902	2,723	5,528	6,705	7,332	7,852	7,568	3,050	19,7	8,1	2,1	0,3	8,8	10,7
10	1,066	1,251	1,536	1,671	1,487	—	0,682	0,847	1,108	1,404	1,523	—	56,3	47,7	38,6	19,0	2,4	—
11	0,649	0,919	1,442	2,011	2,600	—	1,864	2,090	1,925	1,712	1,505	—	65,2	56,0	25,1	17,5	72,8	—
12	1,539	2,041	2,565	2,590	2,700	—	1,520	2,060	2,330	2,630	2,670	—	1,3	0,9	10,1	1,5	1,1	—
13	0,849	1,218	1,684	2,125	2,004	—	1,423	1,642	1,950	1,893	1,724	—	40,3	25,8	13,6	12,3	16,2	—
14	1,195	1,606	2,190	2,177	1,530	—	2,138	2,444	2,368	2,009	1,300	—	44,1	34,3	7,5	-8,4	-17,7	—

Studies have shown that the displacement of the sensors, which are about 50% of the dose, relative to the original positions of the sources at 6 mm, the average error is 25%. This result shows how important it is for brachytherapy applicators to remain unbiased after obtaining planning images to remain in their original positions and not to experience bias.

In Vitebsk regional clinical oncology center for 3D planning uses images obtained from a computer tomograph, which determines the volume of the target and critical organs. The Eclipse 3D planning system allows you to evaluate the total plan of remote and intracavitary therapy using the dose-volume histogram (DVH-dose-volume histogram). The use of different methods of radiation therapy planning increases the effectiveness of combined radiation therapy for cancer of the body and cervix and improves the quality of life of cancer patients by minimizing the frequency of undesirable side effects.

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SPATIAL LINEARITY IN MRI QUALITY CONTROL

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The main characteristic of MRI quality control.

Keywords: MRI, spatial linearity, quality control.

Currently, magnetic resonance imaging (MRI) is widely used to obtain high-quality diagnostic data in many medical institutions. This interest in MRI is primarily due to the possibility of providing high spatial and contrast resolution in the recorded images of soft tissues without injection of potentially toxic contrast agents, the ability to visualize hard-to-reach areas and obtain specific characteristics of tissues depending on the pulse sequences used. MRI equipment has a rather complex design and can pose electromagnetic and electrical danger to both the patient and the staff of the MRI office. To ensure the safety of patients and medical personnel, as well as to prevent the registration of false diagnostic information, it is necessary to ensure proper monitoring of MRI parameters and characteristics.

Based on the study and analysis of foreign sources the spatial nonlinearity can be identified as the most important characteristic. Spatial linearity is a term used to describe the degree of geometrical distortion present in images produced by any imaging system. Geometrical distortion can refer to either displacement of displayed points within an image relative to their known location, or improper scaling of the distance between points anywhere within the image.

The phantom to be used to measure spatial linearity should occupy at least 60% of the largest field-of-view and consist of a regular array of objects (holes, grooves, rods, or tubes) of known dimensions and spacing, and the phantom filled with signal producing material. The objects within the array should be of a size in which the location can be measured and spaced in a regular pattern (typically every 1–2 cm). The dimensional positioning